

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 7 901 NORTH 5TH STREET KANSAS CITY, KANSAS 66101 AUG 2 1 2008

MEMORANDUM

SUBJECT: Vapo

Vapor Intrusion Pathway Assessment

SPX/Former Marley Pump Company

Davenport, Iowa

FROM:

Jeremy Johnson

Toxicologist ENSV/AMB

TO:

David Garrett

Project Manager AWMD/RCAP

As requested, we have reviewed the vapor intrusion (VI) pathway assessment conducted at SPX/Former Marley Pump Company (Marley Pump) site, located in Davenport, Iowa. The intent of our review was to determine whether the previous VI assessment contained in the 2004 Site Assessment & Risk Evaluation & Response Action Report has adequately evaluated the pathway. Specifically, we evaluated the assessment and sampling protocols for consistency with USEPA VI guidance. Below we have provided a summary of our review, conclusions, and recommendations.

Marley Pump evaluated the vapor into indoor air pathway though the use of the Johnson & Ettinger (J&E) Model and the collection of soil vapor samples. The J&E Model was utilized to back-calculate groundwater contaminant concentrations that would result in indoor air levels equaling a cancer risk level of 1E-04 or hazard index (HI) of 1. Both the residential and occupational scenarios were used to generate these groundwater "screening" levels, which were then compared to groundwater monitoring data. Upon this comparison, Marley Pump found that contaminant levels in groundwater did not exceed the screening levels. In addition to this evaluation, Marley Pump also collected a few soil vapor samples in a boring near monitoring well (MW-3d) where the highest detections of trichloroethylene (TCE) in groundwater had been recorded. Except for methylene chloride, all other analytes including TCE were not detected with a reporting limit of 5,000 $\mu g/m^3$. However, while not part of a vapor intrusion pathway investigation, a previous soil vapor investigation in 1994 had detections of TCE and other volatile organic compounds (VOCs) above 29,000 $\mu g/m^3$.



Based on our review of Marley Pump's VI assessment and existing soil vapor and groundwater data, Marley Pump has not adequately evaluated the vapor intrusion pathway. Marley Pump's assessment is not consistent with the USEPA's 2002 draft VI guidance, which should include an evaluation of all vapor sources (groundwater and soil), a comparison of contaminant concentrations to generic and semi-site specific screening levels, and if needed, the collection of direct building related measurements. Marley Pump's evaluation focused on groundwater contamination and failed to address residual soil contamination that may be present under and/or adjacent to the building. As discussed in EPA guidance, soils represent a greater vapor intrusion threat than groundwater (USEPA, 2002). Also, Marley Pump's evaluation of groundwater relied mostly on J&E modeling, which is intended to be complementary to direct buildingrelated measurements (USEPA, 2002). In using the J&E Model, Marley Pump set carcinogenic screening levels at a 1E-04 cancer risk, which is the upper end of USEPA's acceptable cancer risk range. As discussed in the J&E User's Guide, the model is a screening tool and does not predict exact concentrations (USEPA, 2004). With this in mind, there is little room for error as the screening level cancer risk is at the upper end of the acceptable cancer risk range. A more appropriate cancer risk level for screening the pathway is 1E-06, EPA's point of departure. Finally, the modeling assumed slab ongrade structures not buildings with basements, which are typically at a greater threat from vapor intrusion. Buildings with basements could be constructed over the groundwater and residual soil contamination in the future.

Although Marley Pump's vapor intrusion evaluation focused on groundwater modeling, they did assess the 2004 soil gas samples. However, the detection limits were too high to accurately evaluate the vapor intrusion pathway (i.e., well above risk-based screening levels). Also, the vapor samples collected during 2004 focused on the groundwater contamination (i.e., MW-3d). These samples may not be representative of conditions under the building or within the areas of residual soil contamination. While we do recognize the age of the 1994 data and that it may not represent current conditions, that data was not considered during Marley Pumps vapor intrusion evaluation.

Given that Marley Pump's VI assessment is not consistent with USEPA guidance, we have re-evaluated the pathway using groundwater and soil vapor data. Soil data was not used in the following steps as it generally warrants the collection of building-related measurements, since reliable soil screening levels cannot be estimated. Despite this we continued with a streamlined evaluation of the groundwater and soil vapor data by skipping to the semi-site-specific assessment of the 2002 VI guidance, which includes a comparison of contaminant concentrations to semi-site-specific screening levels. Screening levels were developed for both a slab on-grade structure and a building with a basement. The attenuation factors that were used to derive the slab on-grade screening levels are based on site-specific information including the depth to contamination (water table or soil vapor probe depth) and soil type. Attenuation factors for the basement scenario were based on conservative default values given that the depth to contamination (<5 feet) prohibits the use of semi-site-specific values. Specifics regarding the attenuation factors are provided in each table's footnotes. In addition to the screening, we also re-ran the J&E Model using default assumptions and site-specific information.

Tables 1, 2, and 3 show the screening level comparisons and the results of the J&E modeling.

Table 1. Soil Vapor Screening (ug/m³)

	1,1-DCE	1,2-DCE	1,1,1-TCA	TCE
		(total)		
1994 1	6,000	163,000	>10,000	>29,000
2004 ²	5,000 U	5,000 U	5,000 U	5,000 U
Semi-Site-Specific Screening Level (slab on-grade) ^{3,4}	105,000 nc	31,500 nc	2,600,000 nc	600 c
Semi-Site Specific Screening Level (basement) ^{3,5}	2,100 nc	630 nc	520,000 nc	12 c

U: Analyte not detected (reporting limit shown).

Table 2. Groundwater Screening (µg/L)

	1,1- DCA	1,1- DCE	cis-1,2- DCE	trans-1,2- DCE	TCE	Vinyl Chloride
Maximum Detect ¹	927	218	19,100	220	30,100	36.1
Semi-Site Specific	33 c	955 nc	1853 nc	829 nc	15 c	0.7 с
Screening Level (slab on-grade) ^{2,3}	·					
Semi-Site Specific	7 c	191 nc	371 nc	166 nc	3 c	0.2 c
Screening Level (basement) ^{2,4}			·			

nc: Screening level based on non-cancer hazard index of 1.

nc: Screening level based on non-cancer hazard index of 1.

c: Screening level based on a 1E-06 cancer risk level. Maximum concentration detected during soil gas sampling in 1994 (TRC, 1994).

Maximum concentration during soil gas sampling in 2004 (DECI, 2004).

Screening Level = Risk-based screening level for ambient air/attenuation factor. Risk-based screening levels were derived from the ambient air screening levels in the Regional Screening Table at http://epa-prgs.ornl.gov/chemicals/index.shtml. For the purposes of screening, 1, 2-DCE's screening level was based on trans-1, 2-DCE.

⁴ The screening level assumes a slab-on-grade structure and was developed using a semi-site-specific attenuation factor of 0.002 for soil vapor based on a depth of 9 feet (i.e., vapor probe depth) and silty clay loam soil type (DECI, 2004). See Figure 3a of the draft VI guidance (USEPA, 2002).

⁵ This screening level assumes a building with a basement is constructed above the contamination and was developed using an attenuation factor of 0.1. This value is recommended for screening soil vapor when the sample or vapor source is within 5 feet of the slab (USEPA, 2002), which would be the case given shallow groundwater is found at approximately 10 feet below ground surface.

c: Screening level based on a 1E-06 cancer risk level.

Maximum concentration detected during most recent round of groundwater sampling (DECI, 2004).

² Screening Level = (Risk-based screening level*10⁻³m³/L)/(Dimensionless Henry's Law*attenuation factor). Risk-based screening levels were derived from the Region Risk Tables available on-line at http://epa-prgs.ornl.gov/chemicals/index.shtml For the purposes of screening, cis-1,2-DCE's screening level was based on trans-1,2-DCE' screening level.

³ The screening level assumes a slab-on-grade structure and was developed using a semi-site-specific attenuation factor of 2E-04 for groundwater based on depth to groundwater of 9.5 feet and silty clay loam soil type (DECI, 2004). See Figure 3a of the draft VI

guidance (USEPA, 2002).

The screening level assumes a building with a basement is constructed above the contamination. Given the shallow depth to groundwater contamination (potentially less than 5 feet with a basement), this screening level was developed using an attenuation factor of 0.001. This upper-bound value is recommended by guidance (USEPA, 2002).

Table 3. Johnson & Ettinger Model Run (Slab On-Grade Only)^{1,2}

	Predicted Indoor Air Concentration (µg/m³)	Cancer Risk Estimate ³	Non-Cancer HI ³
1,1-DCA	0.8	1E-07	0.0004
1,1-DCE	1.65		0.002
cis-1,2-DCE ⁴	29	-	0.1
trans-1,2-DCE	0.6	-	0.0004
TCE	78	1E-05	0.4
Vinyl Chloride	0.4	1E-07	0.001

The model was unable to evaluate the basement scenario given the shallow depth to groundwater (<10 feet). Per the J&E Model, the depth to the bottom of the basement floor must be greater than the depth to the water table minus the capillary fringe. At 8 feet below ground surface, the basement is within the capillary fringe of a silty clay loam.

Tables 1 and 2 show that the maximum detected levels of VOCs in soil vapor and groundwater are above risk-based screening levels for the vapor intrusion pathway. In regards to soil vapor, the most recent round of soil vapor sampling shows that the detection limit for TCE far exceeds its screening levels. The detection limits for 1,1-DCE and 1.2-DCE (total) only exceed the screening level for the basement scenario. 1,1,1-TCA does not exceed its screening level. When considering the 1994 data, 1,1,-DCE, 1.2-DCE (total), and TCE exceed both of their respective screening levels. As for groundwater, all contaminants exceeded at least one of their screening levels and TCE exceeded its screening levels by 100-1000 times.

The J&E Modeling predicts that only TCE will exceed a cancer risk level of 1E-06 in slab on-grade buildings. All non-cancer HIs are below one and all other cancer risks are below 1E-06. Modeling was attempted for buildings with basements, but given the shallow depth to groundwater, the bottom of the basement would fall within the capillary fringe. Therefore, the J&E Model cannot be used to evaluate the pathway for buildings with basements. Keep in mind that the modeling and the semi-site-specific screening did not consider residual soil contamination.

Based on our evaluation of the pathway, there may be the potential for the vapor intrusion pathway to result in contaminant concentrations in indoor air that pose unacceptable human health risks to occupants in current and future buildings located onsite. This is not including the potential threats that residual soil contamination may pose to the vapor intrusion pathway. Therefore, we recommend additional investigations be conducted at the site to evaluate the pathway and determine whether actions are necessary to prevent exposures. This investigation should account for both groundwater and residual soil contamination. Also, the evaluation should consider off-site receptors especially if any structures reside within 100 feet of site-related contamination.

See Attachments for J&E Model input and output files.

³ Risk estimates were calculated according to the industrial air screening level equation provided in Regional Screening Table User's Guide.

⁴ trans-1,2-DCE is used as a surrogate for deriving health risks for cis-1,2-DCE.

References

- Delta Environmental Consultants, Inc. (DECI). 2004. Site Assessment & Risk Evaluation & Response Action Report. SPX/Former Marley Pump, Davenport, Iowa. Delta Project: 1928-SPX-1.
- Tracer Research Corporation (TRC). 1994. Vapor Trace® Shallow Soil Gas Investigation. Marley Pump Company, Davenport, Iowa.
- U.S. EPA. 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway From Groundwater and Soils (Subsurface Vapor Intrusion Guidance). Office of Solid Waste and Emergency Response, Washington, DC.
- U.S. EPA. 2004. User's Guide for Evaluating Subsurface Vapor Intrusion Into Buildings. Office of Emergency and Remedial Response, Washington, D.C.

Attachments

CHEMICAL PROPERTIES SHEET

V-ADV 3.1; 02/04	CALCULATE RIS	SK-BASED GRO	UNDWATER CONC	CENTRATION	(enter "X" in "YES" b	oox)				•		
		YES			•							
eset to efaults	CALCULATE INC	CREMENTAL RIS	OR SKS FROM ACTUA	L GROUNDW	ATER CONCENTRA	ATION (enter "X" in "	YES" box and initial gr	oundwater conc. I	below)			
		YES	X]								
	ENTER	ENTER										
	Chemical	groundwater									•	
	CAS No. (numbers only,	conc., C _w			•							
	no dashes)	(μg/L)			Chemical							
	107062	9.27E+02			1,2-Dichloroeth	ane	5					. •
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER ust add up to value of	ENTER of Lwt (cell G28)	ENTER	ENTER	ENTER Soil		ENTER	
MORE	Average	below grade			Thickness	Thickness			stratum A		User-defined	·
<u> </u>	soil/ groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C.	Soil stratum	SCS	SCS		stratum A	
	temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above	soil type	soil type (used to estimate	OR	soil vapor permeability,	İ
	Ts	LF	L _{WT}	, h _A	h _{EL}	h _c	water table,	directly above	soil vapor		k,	
	(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)	:	(cm²)	
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	ENTER	ENTER	ENTER	ENTER	ENTER	CAITED	PAITPE	FNTCO				
MORE	Stratum A	Stratum A	Stratum A	Stratum A	Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
Ψ	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled	SCS	soil dry	soil total	soil water-filled
	soil type	bulk density,	porosity, n ^A	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
	Lookup Soil Parameters	ρ _ь ^A (g/cm³)	n (unitless)	θ _w ^A (cm³/cm³)	Lookup Soil Parameters	ρ _δ ^B (g/cm³)	n ^B	θ _w ^B (cm³/cm³)	Lookup Soil Parameters	ρ _b ^C	n ^c	θ _w ^C
		(g/ciii)	(unidess)	(GIT /GIT)		(g/cm)	(unitless)	(cm /cm)		(g/cm³)	(unitless)	(cm³/cm³)
	SICL	1.43	0.459	0.215	С	1.43	0.459	0.215	С	1,43	0.459	0.215
MORE	ENTER Enclosed	ENTER	ENTER Enclosed	ENTER Enclosed	ENTER	ENTER	ENTER		ENTER			
¥	space	Soil-bldg.	space	space	Enclosed	Floor-wall	Indoor		Average vapor flow rate into bldg.			
	floor	pressure	floor	floor	space	seam crack	air exchange		OR			
	thickness,	differential, ΔP	length,	width,	height,	width,	rate,	L	eave blank to calcula	ite ·		
	L _{crack} (cm)	(g/cm-s ²)	L _B (cm)	W _B (cm)	H _B (cm)	(cm)	ER (1/h)		Q _{soil}			
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	10	40	1000	1000	366	0.1	0.25]	5			
MORE	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
•	Averaging time for	Averaging time for	Exposure	Exposure	Target risk for	Target hazard quotient for						•
	carcinogens,	noncarcinogens		frequency,	carcinogens,	noncarcinogens,						
	AT _C	AT _{NC}	ED	EF	TR	THQ		•				
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
	70	25	25	250	1.0E-06	1						
							1					
						ılate risk-based						
END						late risk-based concentration.		•				

CHEMICAL PROPERTIES SHEET

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ	L _T	θ_a^{A}	$\theta_a^{\ B}$	θ_{a}^{C}	Ste	k _i	k _m	k _v _	L _{cz}	n _{cz}	$\theta_{a,cz}$	$\theta_{w,cz}$	X _{crack}
(sec)	(cm)	(cm³/cm³)	(cm ³ /cm ³)	(cm³/cm³)	(cm³/cm³)	(cm ²)	(cm²)	(cm²)	(cm)	(cm ³ /cm ³)	(cm³/cm³)	(cm³/cm³)	(cm)
7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
Bldg ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ²)	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔH _{v,TS} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, µ _{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, Deff (cm²/s)	Stratum C effective diffusion coefficient, Deff c (cm²/s)	Capillary zone effective diffusion coefficient, Deff cz (cm²/s)	Total overall effective diffusion coefficient, D ^{eff} T (cm ² /s)	Diffusion path length, L _d (cm)
2.54E+04	1.00E+06	4.00E-04	0	8,510	4.84E-04	2.07E-02	1.76E-04	4.52E-03	0.00E+00	0.00E+00	1.48E-04	3.09E-04	290
Convection path length, L _p (cm)	Source vapor conc., C _{source} (μg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm³/s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm ²)	Exponent of equivalent foundation Peclet number, exp(Pe ^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (μg/m³) ⁻¹	Reference conc., RfC (mg/m³)			
0	1.92E+04	0.10	8.33E+01	4.52E-03	4.00E+02	2.32E+200	4.14E-05	7.96E-01	2.6E-05	NA NA] .		•
END	1)		•		

GW-ADV ersion 3.1; 02/04		SK-BASED GROU	NDWATER CON	CENTRATION (enter "X" in "YES" b	ox)						
Reset to Defaults		YES CREMENTAL RISI	OR (S FROM ACTUA] AL GROUNDWA	TER CONCENTRA	ATION (enter "X" in "\	/ES" box and initial gr	oundwater conc. (below)		*. *	
		YES	X]		•	· · · · · · · · · · · · · · · · · · ·					
	ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C _w (μg/L)	•		Chemical							
	75354	2.18E+02] .		1,1-Dichloroethy	lene						
MORE 🔱	Average soil/ groundwater temperature,	ENTER Depth below grade to bottom of enclosed space floor,	ENTER Depth below grade to water table,	Thickness of soil stratum A,	ENTER st add up to value o Thickness of soil stratum B, (Enter value or 0)	Thickness of soil stratum C, (Enter value or 0)	ENTER Soil stratum directly above	ENTER SCS soil type	ENTER Soil stratum A SCS soil type (used to estimate	OR	ENTER User-defined stratum A soil vapor permeability,	
	T _s (°C)	L _F . (cm)	L _{WT} (cm)	h _A (cm)	h _B (cm)	h _C (cm)	water table, (Enter A, B, or C)	directly above water table	soil vapor permeability)	-	k, (cm²)	
	11.1	0	290	290	0	0	Α	SICL	SICL	·		•
MORE ¥	ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, Pb (g/cm³)	ENTER Stratum A soil total porosity, n ^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ _w ^A (cm³/cm³)	ENTER Stratum B SCS soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, pb ^B (g/cm³)	ENTER Stratum B soil total porosity, n ^B (unitless)	ENTER Stratum B soil water-filled porosity,	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soil dry bulk density, Pb (g/cm³)	ENTER Stratum C soil total porosity, n ^c (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^{C} (cm³/cm³)
	SICL	1.43	0.459	0.215	С	1.43	0.459	0.215	С	1.43	0.459	0.215
MORE ¥	ENTER Enclosed space floor thickness, L _{creck} (cm)	ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	ENTER Enclosed space floor length, L _B (cm)	ENTER Enclosed space floor width, W _B (cm)	ENTER Enclosed space height, H _B (cm)	ENTER Floor-wall seam crack width, w (cm)	ENTER Indoor air exchange rate, ER (1/h)	. j. .	ENTER Average vapor flow rate into bldg. OR eave blank to calculat Q _{sol} (L/m)	9		
	10	40	1000	1000	366	0.1	0.25	= ,]	5			
MORE 🗸	ENTER Averaging time for	ENTER Averaging time for	ENTER Exposure	ENTER Exposure	ENTER Target risk for	ENTER Target hazard quotient for	<u> </u>					
	carcinogens, AT _c (yrs)	noncarcinogens, AT _{NC} (yrs)	duration, ED (yrs)	frequency, EF (days/yr)	carcinogens, TR (unitless)	noncarcinogens, THQ (unitless)						
	70	25	25	250	1.0E-06	1	1					
END	1 .					late risk-based concentration.						

	Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
	τ (sec)	L _T	θ _a ^A (cm³/cm³)	θ _a ^B (cm³/cm³)	θ _a ^C (cm³/cm³)	S _{te} (cm³/cm³)	k _i (cm²)	k _m (cm²)	k _v (cm²)	L _{cz} (cm)	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	X _{crack}
-	(000)	(0.07)		(**************************************	(6.1.101.)	(5,	(5)	(0117)	(om)	(CIII)	(GIII /GIII)	(cm /cm)	(CIT /CIT)	(cm)
[7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
		Area of enclosed	Crack-	Crack	Enthalpy of	Henry's law	Henry's law	Vapor	Stratum A	Stratum B	Stratum C	Capillary zone	Total overali	
	Bldg. ventilation rate,	space below grade,	to-total area ratio,	depth below grade,	vaporization at ave. groundwater temperature,	constant at ave. groundwater temperature,	constant at ave. groundwater temperature,	viscosity at ave. soil temperature,	effective diffusion coefficient,	effective diffusion coefficient,	effective diffusion coefficient,	effective diffusion coefficient,	effective diffusion coefficient,	Diffusion path length,
	Q _{building} . (cm³/s)	A _B (cm²)	η (unitless)	Z _{crack} (cm)	ΔH _{v.TS} (cal/mol)	H _{TS} (atm-m³/mol)	H' _{TS} (unitless)	μ _{TS} (g/cm-s)	D ^{eff} _A (cm²/s)	D ^{eff} _B (cm²/s)	D ^{eff} _C (cm²/s)	D ^{eff} cz (cm²/s)	D ^{eff} _T (cm²/s)	L _d (cm)
														(CIII)
l	2.54E+04	1.00E+06	4.00E-04	0	6,385	1.54E-02	6.59E-01	1.76E-04	3.90E-03	0.00E+00	0.00E+00	3.97E-05	8.49E-05	290
	Convection path	Source	Crack	Average vapor flow rate	Crack effective diffusion	A	Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit	:			
	length,	vapor conc.,	radius,	into bldg.,	coefficient,	Area of crack,	Peclet number,	attenuation coefficient,	bldg. conc.,	risk factor,	Reference conc.,			
	L _p (cm)	C _{source} (μg/m³)	r _{crack} (cm)	Q _{soil} (cm ³ /s)	D ^{crack} (cm²/s)	A _{crack} (cm ²)	exp(Pe ^f) (unitless)	α (unitless)	C _{building} (µg/m³)	URF (μg/m ³) ⁻¹	RfC (mg/m³)			
								, , , , , , , , , , , , , , , , , , , ,					*	
ı	0	1.44E+05	0.10	8.33E+01	3.90E-03	4.00E+02	1.60E+232	1.15E-05	1.65E+00) NA	2.0E-01			
[END									ノ				

	W-ADV n 3.1; 02/04	CALCULATE RIS	SK-BASED GROU	NDWATER CON	CENTRATION	enter "X" in "YES" b	ox)						•
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	eraults	CALCULATE INC	CREMENTAL RISI	KS FROM ACTUA	AL GROUNDW/	ATER CONCENTRA	ATION (enter "X" in ")	ES" box and initial gr	oundwater conc.	below)			
		•	YES	X]						•		
		ENTER	ENTER										
		Chemical	Initial groundwater										
		CAS No.	conc.,										•
		(numbers only, no dashes)	C _w (μg/L)			Chemical	2						
		156592	1.91E+04	. 1		is-1,2-Dichloroet	hylene			•			
				J									
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	MORE	Average	below grade	D #-		Thickness	Thickness			stratum A		User-defined	
		soil/ groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C,	Soil stratum	scs	SCS soil type		stratum A soil vapor	
		temperature.	space floor,	to water table,	stratum A,		(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	•
		T _s (℃)	L _F (cm)	L _{WT} (cm)	h _A (cm)	h _B (cm)	h _C (cm)	water table, (Enter A, B, or C)	directly above water table	soil vapor		k, (cm²)	
								(Ciner A, D, Or C)		permeability)		(611)	•
		11.1	0	290	290	0	0	Α	SICL	SICL]
												•	
	MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER Stratum B	ENTER	ENTER Stratum C	ENTER Stratum C	ENTER Stratum C
	MORE Ψ	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	ENTER Stratum C soil water-filled
		Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
		Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\ \ \mathbf{C}}$
		Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, θ _w ^A (cm ³ /cm ³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
		Stratum A SCS Soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n^ (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, $ ho_b^B$ (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, $\theta_{\rm w}^{\ \ \rm B}$	Stratum C SCS Soil type Lookup Soil Parameters	Stratum C soil dry bulk density, Pb ^C	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_{\mathbf{w}}^{\ \ \mathbf{C}}$
		Stratum A SCS Soil type Lookup Soil Parameters SICL ENTER	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
		Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space	Stratum A soil dry bulk density, p.6^ (g/cm³) 1.43 ENTER Soil-bldg.	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed	Stratum B soil dry bulk density, Pb B (g/cm³) 1.43 ENTER Floor-wall	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg.	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS Soil type Lookup Soil Parameters SICL ENTER Enclosed space floor	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg, pressure	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor	Stratum A soil water-filled porosity, 0 % (cm³/cm³) 0.215 ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, p.6^ (g/cm³) 1.43 ENTER Soil-bldg.	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height,	Stratum B soil dry bulk density, p _b ^B (g/cm³) 1.43 ENTER Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bidg. OR Leave blank to calculat	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS Soil type Lookup Soil Parameters SICL ENTER Enclosed space floor	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg. pressure differential,	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor	Stratum A soil water-filled porosity, 0 % (cm³/cm³) 0.215 ENTER Enclosed space floor	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm)	Stratum A soil dry bulk density, p. A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless) O.459 ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm)	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack	Stratum A soil dry bulk density, ρ_b^A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, p. B (g/cm³) 1.43 ENTER Floor-wall seam crack width, w	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER	Stratum A soil dry bulk density, ps (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless) O.459 ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm)	Stratum B SCS Soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm)	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, AP (g/cm-s²)	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor length, Ls (cm) 1000 ENTER	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Ph (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, AP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens,	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER Exposure frequency,	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, ps A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, ΔT_{NC}	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, HB (cm) 366 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, p. A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless) O.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER Exposure frequency, EF (days/yr)	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, ps A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, ΔT_{NC}	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER Exposure frequency, EF	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, HB (cm) 366 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE V	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, p. A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n^ (unitless) O.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER Exposure frequency, EF (days/yr)	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, HB (cm) 366 ENTER Target risk for carcinogens, TR (unitless) 1.0E-06 Used to calcul	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, e _w (cm ³ /cm ³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculat Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)

	Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
	τ (sec)	L _T (cm)	θ_a^A (cm ³ /cm ³)	θ _a ^B (cm³/cm³)	θ _a ^C (cm³/cm³)	S _{te} (cm³/cm³)	k _i (cm²)	k _{rq} (cm²)	k _v (cm²)	L _{cz} (cm)	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	. X _{crack} (cm)
•	7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
	7.002 00		<u> </u>		V.2.11	. 0.000	1.712-00	0.703	1.002-09	100.90	0.400	0.000	0.333	1 4,000
	Bldg. ventilation rate, Q _{building} (cm³/s)	Area of enclosed space below grade, A _B (cm ²)	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔH _{v,TS} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μτs (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm²/s)	Stratum C effective diffusion coefficient, D ^{eff} c (cm ² /s)	Capillary zone effective diffusion coefficient, Deff cz (cm²/s)	Total overall effective diffusion coefficient, Deff (cm²/s)	Diffusion path length, L _d (cm)
-	2.54E+04	1.00E+06	4.00E-04	0.	7,723	2.15E-03	9.22E-02	1.76E-04	3.19E-03	0.00E+00	0.00E+00	5.69E-05	1.21E-04	T 290
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q _{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm²/s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pef) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³)-1	Reference conc., RfC (mg/m³)			
· [0 END	1.76E+06	0.10	8.33E+01	3.19E-03	4.00E+02	4.64E+283	1.63E-05	2.87E+01	NA	3.5E-02			

GW-ADV /ersion 3.1; 02/04	CALCULATE RIS	K-BASED GROU	NDWATER CON	CENTRATION (enter "X" in "YES" b	ox)						
Reset to		YES	OR]		•						
Defaults	CALCULATE INC	REMENTAL RISH	KS FROM ACTUA	AL GROUNDWA	TER CONCENTRA	ATION (enter "X" in ")	ES" box and initial gr	oundwater conc. b	elow)			
•		YES	X									
	ENTER Chemical	ENTER Initial groundwater									, i	
	CAS No. (numbers only, no dashes)	conc., C _W (μg/L)			Chemical						v	
	156605	2.20E+02	- ·]	tra	ns-1,2-Dichloroe	ethylene	•					
	ENTER	ENTER Depth	ENTER	ENTER Totals mu	ENTER st add up to value o	ENTER	ENTER	ENTER	ENTER Soil	•	ENTER	,
MORE ¥	Average soil/ groundwater temperature, T _s (°C)	below grade to bottom of enclosed space floor, L _F (cm)	Depth below grade to water table, L _{WT} (cm)	Thickness of soil stratum A,	Thickness of soil stratum B, (Enter value or 0) h _B (cm)	Thickness of soil stratum C, (Enter value or 0) h _C (cm)	Soil stratum directly above water table, (Enter A, B, or C)	SCS soil type directly above water table	stratum A SCS soil type (used to estimate soil vapor permeability)	OR	User-defined stratum A soil vapor permeability, k, (cm²)	
•	11.1	0	290	290	0	0	Α	SICL	SICL	: 1		
	,		. 200	230				I SICE	SICL	<u>.</u>		
MORE ¥	ENTER Stratum A SCS soil type Lookup Soil Parameters	ENTER Stratum A soil dry bulk density, ρ_b^A (g/cm³)	ENTER Stratum A soil total porosity, n ^A (unitless)	ENTER Stratum A soil water-fillec porosity, θ_w^A (cm³/cm³)	ENTER Stratum B SCS Soil type Lookup Soil Parameters	ENTER Stratum B soil dry bulk density, $ ho_b^B$ (g/cm³)	ENTER Stratum B soil total porosity, n ^B (unitless)	ENTER Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	ENTER Stratum C SCS soil type Lookup Soil Parameters	ENTER Stratum C soit dry bulk density, Pb (g/cm³)	ENTER Stratum C soil total porosity, n ^C (unitless)	ENTER Stratum C soil water-filled porosity, θ_w^c (cm³/cm³)
	SICL	1.43 、	0.459	0.215	С	1.43	0.459	0.215	С	1.43	0.459	0.215
MORE ₩	ENTER Enclosed space	ENTER Soil-bldg.	ENTER Enclosed space	ENTER Enclosed space	ENTER Enclosed	ENTER Floor-wall	ENTER Indoor		ENTER Average vapor flow rate into bldg.			
	floor thickness, L _{erack}	pressure differential, ΔP	floor length, L _B	floor width, W _B	space height, H _B	seam crack width, w	air exchange rate, ER	Le	OR eave blank to calcula Q _{sol}	ate		
	(cm)	(g/cm-s ²)	(cm)	(cm)	(cm)	(cm)	(1/h)	= :	(L/m)			
	10	40	1000	1000	366	0.1	0.25]	. 5]		
MORE ¥	ENTER Averaging time for	ENTER Averaging time for	ENTER Exposure	ENTER Exposure	ENTER Target risk for	ENTER Target hazard quotient for						
	carcinogens, AT _c	noncarcinogens, AT _{NC}	duration, ED	frequency, EF	carcinogens, TR	noncarcinogens, THQ						
	(yrs)	(yrs)	(yrs)	(days/yr)		(unitless)						
	(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)							•
END				(days/yr)	(unitless) 1.0E-06 Used to calcu	(unitless) 1 Ilate risk-based concentration.						

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
(000)	L _T (cm)	θ _a ^A (cm³/cm³)	θ _a ^B (cm ³ /cm ³)	θ _a ^C (cm³/cm³)	S _{te} (cm ³ /cm ³)	k _i (cm²)	k _{rg} (cm²)	k _v (cm²)	L _{cz}	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	X _{crack}
(sec)	(CIII)	(GIII /GIII /	(61176117)	(cm /cm /	(CITI /CITI)	(Citi)	(CIII)	(Cill)	(cm)	(cm /cm)	(GIII /GIII)	(CIII /CIII)	(cm)
7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ²)	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔΗ _{ν,TS} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m ³ /mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ _{TS} (g/cm-s)	Stratum A effective diffusion coefficient, D ^{eff} A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, D ^{eff} C (cm ² /s)	Capillary zone effective diffusion coefficient, D ^{eff} ez (cm ² /s)	Total overall effective diffusion coefficient, D ^{eff} _τ (cm ² /s)	Diffusion path length, L _d (cm)
2.54E+04	1.00E+06	4.00E-04	0	7,125	5.20E-03	2.23E-01	1.76E-04	3.06E-Q3	0.00E+00	0.00E+00	4.03E-05	8.59E-05	290
Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, rerack (cm)	Average vapor flow rate into bldg., Q _{soil} (cm³/s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe¹) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., Cbuilding (µg/m³)	Unit risk factor, URF (µg/m³) ⁻¹	Reference conc., RfC (mg/m³)	• 1		
END	1	0.10	J 0.00L-01	3.002-03	1 4.00E+02	1 0.0111230	1.102-03	1/ 0.09E-01/	J NA	1 1.0E-02]		

	GW-ADV	CALCULATE RIS	K-BASED GROU	NDWATER CON	CENTRATION (enter "X" in "YES" be	ox)						
era	sion 3.1; 02/04		YES	· · · · · · · · · · · · · · · · · · ·	1								
	Reset to		120	OR	3								
	Defaults	CALCULATE INC	REMENTAL RISH		L GROUNDWA	TER CONCENTRA	TION (enter "X" in "Y	'ES" box and initial gro	oundwater conc.	below)			
_					•				•				
			YES	Х	<u>.</u>				•	1			
	•	ENTER	ENTER										
		CHILIN	Initial										
		Chemical	groundwater										
		CAS No. (numbers only,	conc., C _w								***		
		no dashes)	(μg/L)	_		Chemical							
	•	79016	3.01E+04]	L	Trichloroethyle	ene						
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	l '
			Depth		Totals mu	st add up to value o				Soil			
	MORE ↓	Average soil/	below grade	D#-	Thislesses	Thickness	Thickness	C-11		stratum A		User-defined	l .
		groundwater	to bottom of enclosed	Depth below grade	Thickness of soil	of soil stratum B,	of soil stratum C,	Soil stratum	scs	SCS soil type		stratum A soil vapor	
		temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)		directly above	soil type	(used to estimate	OR	permeability,	
		Ts	L _F	L _{WT}	h _A	h _B	, ħ _C	water table,	directly above	1		k,	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		11.1	0	290	290	0	0	Α	SICL	SICL			1
	4			-									-
	•			ENTER	ENTER	ENTER	ENTER	ENTER	CATED		ENTER	FAITER	
		ENIER	ENIER	ENIER	ENIER	ENIER	ENIER	CIVIER	ENIER	ENIER	CIVIER	ENIER	ENIER
	MORE	ENTER Stratum A	ENTER Stratum A	ENTER Stratum A	Stratum A	Stratum B	Stratum B	Stratum B	ENTER Stratum B	ENTER Stratum C	Stratum C	ENTER Stratum C	ENTER Stratum C
	MORE ↓	Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-fillec	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-filled
	MORE ¥	Stratum A SCS soil type	Stratum A soil dry bulk density,	Stratum A soil total porosity,	Stratum A soil water-filled porosity,	Stratum B SCS soil type	Stratum B soil dry bulk density,	Stratum B soil total porosity,	Stratum B soil water-filled porosity,	Stratum C SCS soil type	Stratum C soil dry bulk density,	Stratum C soil total porosity,	Stratum C soil water-filled porosity,
	MORE ¥	Stratum A SCS	Stratum A soil dry bulk density, Pb	Stratum A soil total porosity, n ^A	Stratum A soil water-fillec porosity, θ_w^A	Stratum B SCS	Stratum B soil dry bulk density,	Stratum B soil total porosity, n ^B	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry bulk density,	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^{\ C}$
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n ^A (unitless)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³)	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters	Stratum C soil dry bulk density, p _b ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil	Stratum A soil dry bulk density, Pb	Stratum A soil total porosity, n ^A	Stratum A soil water-fillec porosity, θ_w^A	Stratum B SCS soil type Lookup Soil	Stratum B soil dry bulk density,	Stratum B soil total porosity, n ^B	Stratum B soil water-filled porosity, $\theta_w^{\ B}$	Stratum C SCS soil type Lookup Soil	Stratum C soil dry bulk density,	Stratum C soil total porosity, n ^C	Stratum C soil water-filled porosity, $\theta_w^{\ C}$
		Stratum A SCS soil type Lookup Soil Parameters SICL ENTER	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215	Stratum B SCS soil type Lookup Soil Parameters	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless)	Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER	Stratum C soil dry bulk density, p _b ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed	Stratum A soil dry bulk density, Pb ^A (g/cm ³)	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed	Stratum A soil water-fillec porosity,	Stratum B SCS Soil type Lookup Soil Parameters C ENTER	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER	Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor	Stratum C soil dry bulk density, p _b ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
		Stratum A SCS Soil type Lookup Soil Parameters SICL ENTER Enclosed space	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg.	Stratum A soil total porosity, n^A (unitless) 0.459 ENTER Enclosed space	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor	Stratum B soil water-filled porosity, θ_w^B (cm³/cm³)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg.	Stratum C soil dry bulk density, p _b ^C (g/cm ³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg, pressure differential,	Stratum A soil total porosity, n^ (unitless) 0.459 ENTER Enclosed	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width,	Stratum B SCS Soil type Lookup Soil Parameters C ENTER	Stratum B soil dry bulk density, Pb ^B (g/cm³)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, L _{crack}	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, w	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness,	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg, pressure differential,	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length,	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width,	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height,	Stratum B soil dry bulk density, pb (g/cm³) 1.43 ENTER Floor-wall seam crack width,	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate,	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg OR Leave blank to calculate	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, L _{crack}	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B	Stratum B soil dry bulk density, pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, w	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE U	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Loreck (cm)	Stratum A soil dry bulk density, Pb (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm)	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm)	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lerack (cm) 10 ENTER	Stratum A soil dry bulk density, Pb ^A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm)	Stratum B SCS Soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE U	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, L _{creck} (cm) 10 ENTER Averaging time for	Stratum A soil dry bulk density, Pb A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W_B (cm) 1000 ENTER	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens,	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration,	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W _B (cm) 1000 ENTER Exposure frequency,	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, w (cm) 0.1 ENTER Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Loreck (cm) 10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb ^A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n* (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED	Stratum A soil water-fillec porosity, \$\theta_w^A\$ (cm³/cm³) 0.215 ENTER Enclosed space floor width, \$W_B\$ (cm) 1000 ENTER Exposure frequency, EF	Stratum B SCS soli type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens,	Stratum A soil dry bulk density, Pb A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED (yrs)	Stratum A soil water-filled porosity, θ_w^A (cm³/cm³) 0.215 ENTER Enclosed space floor width, W _B (cm) 1000 ENTER Exposure frequency,	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens,	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, w (cm) 0.1 ENTER Target hazard quotient for noncarcinogens,	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Loreck (cm) 10 ENTER Averaging time for carcinogens, ATc	Stratum A soil dry bulk density, Pb ^A (g/cm³) 1.43 ENTER Soil-bldg, pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC}	Stratum A soil total porosity, n* (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED	Stratum A soil water-fillec porosity, \$\theta_w^A\$ (cm³/cm³) 0.215 ENTER Enclosed space floor width, \$W_B\$ (cm) 1000 ENTER Exposure frequency, EF	Stratum B SCS soli type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens, TR	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)
	MORE ¥	Stratum A SCS soil type Lookup Soil Parameters SICL ENTER Enclosed space floor thickness, Lorack (cm) 10 ENTER Averaging time for carcinogens, ATc (yrs)	Stratum A soil dry bulk density, Pb A (g/cm³) 1.43 ENTER Soil-bldg. pressure differential, ΔP (g/cm-s²) 40 ENTER Averaging time for noncarcinogens, AT _{NC} (yrs)	Stratum A soil total porosity, n ^A (unitless) 0.459 ENTER Enclosed space floor length, L _B (cm) 1000 ENTER Exposure duration, ED (yrs)	Stratum A soil water-fillec porosity, \$\theta_w^A\$ (cm³/cm³) 0.215 ENTER Enclosed space floor width, \$W_B\$ (cm) 1000 ENTER Exposure frequency, \$\text{EF}\$ (days/yr)	Stratum B SCS soil type Lookup Soil Parameters C ENTER Enclosed space height, H _B (cm) 366 ENTER Target risk for carcinogens, TR (unitless)	Stratum B soil dry bulk density, Pb (g/cm³) 1.43 ENTER Floor-wall seam crack width, W (cm) 0.1 ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	Stratum B soil total porosity, n ^B (unitless) 0.459 ENTER Indoor air exchange rate, ER (1/h)	Stratum B soil water-filled porosity, θ_w^B (cm^3/cm^3)	Stratum C SCS soil type Lookup Soil Parameters C ENTER Average vapor flow rate into bldg. OR Leave blank to calculate Q _{soil} (L/m)	Stratum C soil dry bulk density, Pb ^C (g/cm³)	Stratum C soil total porosity, n ^c (unitless)	Stratum C soil water-filled porosity, θ_w^C (cm³/cm³)

Exposure duration,	Source- building separation,	Stratum A soil air-filled porosity,	Stratum B soil air-filled porosity,	Stratum C soil air-filled porosity,	Stratum A effective total fluid saturation,	Stratum A soil intrinsic permeability,	Stratum A soil relative air permeability,	Stratum A soil effective vapor permeability,	Thickness of capillary zone,	Total porosity in capillary zone,	Air-filled porosity in capillary zone,	Water-filled porosity in capillary zone,	Floor- wall seam perimeter,
τ (sec)	L _T	θ _a ^A (cm³/cm³)	θ _a ^B (cm³/cm³)	θ _a ^C (cm³/cm³)	S _{te} (cm³/cm³)	k _i (cm²)	k _{rg} (cm²)	k _{v.} (cm²)	L _{cz} (cm)	n _{cz} (cm³/cm³)	θ _{a,cz} (cm³/cm³)	θ _{w,cz} (cm³/cm³)	X _{crack} (cm)
(sec)	(ciii)	(0117701117)	(0111 70111)	(on rom)	(om rom /	· (om)	(0)	(6)	(citi)	(6.11.7677.7	(6)	(0, 0,	(City
7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
	Area of						· .	Stratum	Stratum	Stratum	Capillary	Total	
Bldg. ventilation	enclosed space below	Crack- to-total area	Crack depth below	Enthalpy of vaporization at ave. groundwater	Henry's law constant at ave. groundwater	Henry's law constant at ave. groundwater	Vapor viscosity at ave. soil	A effective diffusion	B effective diffusion coefficient,	C effective diffusion coefficient,	zone effective diffusion coefficient,	overall effective diffusion coefficient,	Diffusion path
rate,	grade,	ratio,	grade,	temperature, ΔH _{v.TS}	temperature, H _{TS}	temperature, H' _{TS}	temperature,	coefficient, D ^{eff}	D ^{eff} _B	D ^{eff} c	D ^{eff} cz	D ^{eff} _T	length, L _d
Q _{building} (cm³/s)	A _B (cm²)	η (unitless)	Z _{crack} (cm)	(cal/mol)	(atm-m³/mol)	(unitless)	μ _{τs} (g/cm-s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	(cm²/s)	_a (cm)
2.54E+04	1.00E+06	4.00E-04	Γ ο	8,543	5.08E-03	2.18E-01	1.76E-04	3.42E-03	0.00E+00	0.00E+00	4.10E-05	8.77E-05	290
2.54E+04] 1.00⊆+00	4.000-04		1 0,545	J.00E-03	2.102-01	1.702-04	J.42L-00	0.002.00	0.002.00	T. 10L-00	0.772-00	
Convection	Source		Average vapor	Crack effective	.	Exponent of equivalent foundation	Infinite source indoor	Infinite source	Unit risk	Reference			
path length,	vapor conc.,	Crack radius,	flow rate into bldg.,	diffusion coefficient,	Area of crack,	Peclet number,	attenuation coefficient,	bldg. conc.,	factor,	conc.,			
L _D	C _{source}	r _{crack}	Q _{soil}	D ^{crack}	A _{crack}	exp(Pe ^f)	α	C _{building}	URF	RfC			•
_p (cm)	(μg/m ³)	· crack (cm)	(cm ³ /s)	(cm²/s)	(cm ²)	(unitless)	(unitless)	(μg/m ³)	(μg/m³) ⁻¹	(mg/m³)	•		
			T			1 000-004	1	7 705 04	145.64	T 4 55 65	1		
0 END	6.55E+06	0.10	8.33E+01	3.42E-03	4.00E+02	2.98E+264	1.18E-05	7.76E+01	1.1E-04	4.0E-02	I		• .

GW-ADV		CALCULATE RISE	K-BASED GROU	NDWATER CON	CENTRATION (enter "X" in "YES" b	ox)						
ersion 3.1; 02	2/04												
D			YES		l					•			
Reset to	1			OR									
Defaults	•	CALCULATE INC	REMENTAL RISI	KS FROM ACTUA	L GROUNDWA	TER CONCENTRA	TION (enter "X" in ")	ES" box and initial gro	oundwater conc.	below)			
			V50	· ·	1								
			YES	X	1								
		ENTER	ENTER										
			Initial										
		Chemical	groundwater										
		CAS No.	conc.,					•				100	
	,	(numbers only, no dashes)	C _W (μg/L)			Chemical							
		110 data100)	4-9-7			- CHOINGS					•		
		75014	3.61E+01	1	Viny	d chloride (chlore	oethene)	*			:		
				•								~ .	
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER	
-	5E 1	A	Depth		I otals mu	st add up to value o				Soil		Llear defined	
MOI		Average soil/	below grade to bottom	Depth	Thickness	Thickness of soil	Thickness of soil	Soil		stratum A SCS		User-defined stratum A	
		groundwater	of enclosed	below grade	of soil	stratum B,	stratum C,	stratum	scs	soil type		soil vapor	
		temperature,	space floor,	to water table,	stratum A,	(Enter value or 0)	(Enter value or 0)	directly above	soil type	(used to estimate	OR	permeability,	
		Ts	L _F	L _{WT}	h _A :	h _B	h _C	water table,	directly above	soil vapor		k,	
		(°C)	(cm)	(cm)	(cm)	(cm)	(cm)	(Enter A, B, or C)	water table	permeability)		(cm²)	
		11.1	0	290	290	0	0	Α	SICL	SICL		· · · · · · · · · · · · · · · · · · ·	
		·	<u>_</u>	1200	250				OIOL	1 0/02		<u> </u>	
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER
MOI		Stratum A SCS	Stratum A soil dry	Stratum A soil total	Stratum A soil water-filled	Stratum B SCS	Stratum B soil dry	Stratum B soil total	Stratum B soil water-filled	Stratum C SCS	Stratum C soil dry	Stratum C soil total	Stratum C soil water-fille
<u></u>		soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,	soil type	bulk density,	porosity,	porosity,
		Lookup Soil	ρb ^A	n ^A	θ _w ^	Lookup Soil	Pb ^B	n ⁸	θ_{w}^{B}	Lookup Soil	$\rho_{\mathbf{b}}^{\mathbf{C}}$	nc	θ ^w c
4		Parameters	(g/cm ³)	(unitless)	(cm³/cm³)	Parameters	(g/cm ³)	(unitless)	(cm³/cm³)	Parameters	(g/cm³)	(unitless)	(cm ³ /cm ³)
		SICL	1.43	0.459	0.215	С	1.43	0.459	0.215	C	1.43	0.459	0.215
		ENTER	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER		ENTER			
MOI		Enclosed		Enclosed	Enclosed		*.			Average vapor			
_		space	Soil-bldg.	space	space	Enclosed	Floor-wall	indoor		flow rate into bldg.			
		floor	pressure	floor	floor	space	seam crack	air exchange		OR _eave blank to calculat	•		
		thickness,	differential, ΔP	length, L _s	width, W _B	height, H _B	width, w	rate, ER	. '	Q _{soil}	е		
		L _{crack} (cm)	(g/cm-s²)	(cm)	(cm)	(cm)	(cm)	(1/h)		(L/m)			
				(GAI)		Comy	(0.1.)	77	=		•		
		10	40	1000	1000	366	0.1	0.25]	5			
MOI	DE]	ENTER	ENTER	ENTER	ENTER	ENTER	ENTER						
1110		Averaging	Averaging	LITTER	LINIEN	Target	Target hazard						•
		time for	time for	Exposure	Exposure	risk for	quotient for						
			noncarcinogens,	duration,	frequency,	carcinogens,	noncarcinogens,						
		AT _C	AT _{NC}	ED (vm)	EF (dove/ve)	TR	THQ						
*		(yrs)	(yrs)	(yrs)	(days/yr)	(unitless)	(unitless)						
		70	25	25	250	1.0E-06	1 -	1					
											* -		
<u> </u>	<u> </u>		•		. 1		late risk-based	· ·					
EN	<u> </u>				·	groundwater	concentration.	1					

	Exposure duration, t (sec)	Source- building separation, L _T (cm)	Stratum A soil air-filled porosity, θ_a^A (cm³/cm³)	Stratum B soil air-filled porosity, θ_a^B (cm³/cm³)	Stratum C soil air-filled porosity, e _a ^C (cm³/cm³)	Stratum A effective total fluid saturation, S _{te} (cm³/cm³)	Stratum A soil intrinsic permeability, k _i (cm²)	Stratum A soil relative air permeability, k _{rq} (cm ²)	Stratum A soil effective vapor permeability, k _v (cm²)	Thickness of capillary zone, L _{cz} (cm)	Total porosity in capillary zone, n _{cz} (cm ³ /cm ³)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm³/cm³)	Water-filled porosity in capillary zone, θ _{w,cz} (cm³/cm³)	Floor- wall seam perimeter, X _{crack} (cm)
١	7.88E+08	290	0.244	0.244	0.244	0.339	1.71E-09	0.789	1.35E-09	133.93	0.459	0.060	0.399	4,000
	Bldg. ventilation rate, Q _{building} (cm ³ /s)	Area of enclosed space below grade, A _B (cm ²)	Crack- to-total area ratio, η (unitless)	Crack depth below grade, Z _{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, ΔΗ _{ν,TS} (cal/mol)	Henry's law constant at ave. groundwater temperature, H _{TS} (atm-m³/mol)	Henry's law constant at ave. groundwater temperature, H' _{TS} (unitless)	Vapor viscosity at ave. soil temperature,	Stratum A effective diffusion coefficient, D ^{eff} _A (cm ² /s)	Stratum B effective diffusion coefficient, D ^{eff} _B (cm ² /s)	Stratum C effective diffusion coefficient, Deff c (cm²/s)	Capillary zone effective diffusion coefficient, D ^{eff} cz (cm²/s)	Total overall effective diffusion coefficient, $D^{\text{eff}}_{\text{T}}$ (cm ² /s)	Diffusion path length, L _d (cm)
[2.54E+04	1.00E+06	4.00E-04	0	4,988	1.78E-02	7.65E-01	1.76E-04	4.59E-03	0.00E+00	0.00E+00	4.62E-05	9.88E-05	290
	Convection path length, L _p (cm)	Source vapor conc., C _{source} (µg/m³)	Crack radius, r _{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm ³ /s)	Crack effective diffusion coefficient, D ^{crack} (cm ² /s)	Area of crack, A _{crack} (cm²)	Exponent of equivalent foundation Peclet number, exp(Pe ^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., C _{building} (µg/m³)	Unit risk factor, URF (µg/m³)-1	Reference conc., RfC (mg/m³)			
[0	2.76E+04	0.10	8.33E+01	4.59E-03	4.00E+02	1.43E+197	1.33E-05	3.69E-01	8.8E-06	1.0E-01	[·		
.[END										4			